Application of Michaelis-Menten in the kinetics of oil palm frond enzymatic hydrolysis for ferulic acid production

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Abstract:
Ferulic acid (FA) production has become a frequent focus on today's research due to its antioxidant properties. However, there has been little to none studies reported on the usage of mixed culture as inoculum in FA production. This study aims to determine the kinetics FA production in a mixed culture fermentation by applying the Michaelis-Menten kinetic model. In this study, mixed culture fermentation process using oil palm frond bagasse (OPFB) as substrate was applied for FA production improvement. Optimum condition was applied to study ferulic acid esterase (FAE) mechanism for kinetic modelling purposes. The kinetic model used was based on the Michaelis-Menten kinetic model. Runge-Kutta Fourth Order method was used to solve the kinetic model. Maximum FAE activity was achieved at the 28 h of fermentation process at 3.7 × 10-3 mU mL-1. This result proved that enzymatic hydrolysis occurred during fermentation process. Kinetic study was conducted with Michaelis-Menten kinetic model used as a reference kinetic equation. Three kinetic constants, Vmax, Km and Ks were determined as 3.725 × 10-3 g L-1 h-1, 28.231 g L-1 and 1.3 × 10-2 h-1 respectively using Runge-Kutta Fourth Order approach. The outcome of this study confirms that the kinetics of the process fit well with the Michaelis-Menten model. This also suggests that the usage of mixed culture has the potential to induce enzymatic hydrolysis hence improving FA production from OPFB during fermentation process.

Keywords: Ferulic acid; Oil palm frond; Mixed culture fermentation; Kinetic study; Michaelis-Menten

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